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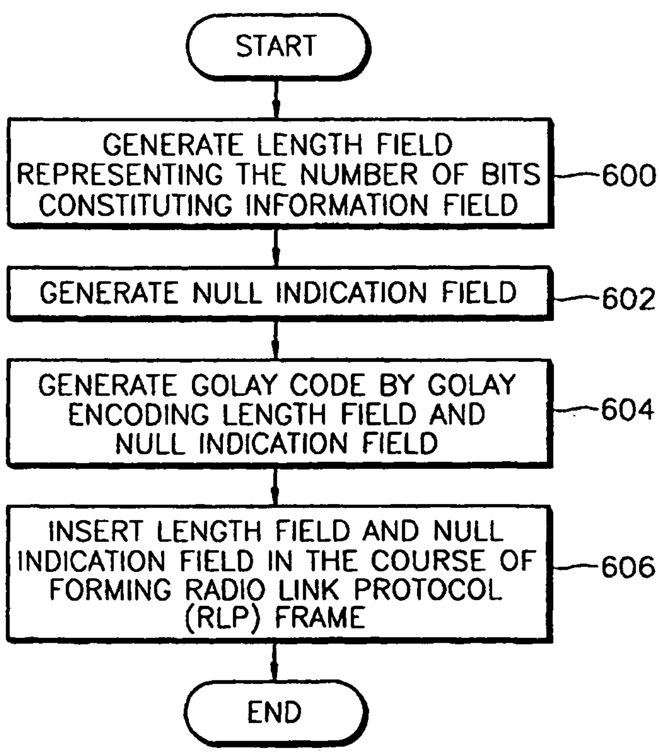
(54) Title: ENCODING METHOD OF MULTIMEDIA DATA AND DEVICE THEREOF



(57) Abstract: An encoding method for wireless transceiving of multimedia data including video data, and an encoding device therefore are provided. The encoding method includes (a) generating a length field representing the number of bits of a payload, (b) generating an error correction code by performing error correction coding with respect to the length field, and (c) inserting the length field and the error correction code during radio link protocol (RLP) framing. The encoding method reduces overhead when multimedia data including video data is transmitted and received under the radio environment, and increases error robustness, thereby improving the quality of an image.

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ENCODING METHOD OF MULTIMEDIA DATA AND DEVICE THEREOF

Technical Field

The present invention relates to coding and decoding methods and packetizing and depacketizing methods, and more particularly, to a method of encoding and decoding and packetizing and depacketizing multimedia data including video data in a wireless transmitting system or in a wireless receiving system.

Background Art

A wireless transmitting device and a wireless receiving device of a wireless code division multiple access (CDMA) system includes a plurality of layers as shown in FIG. 1. A user layer is an application layer. The standards associated with the user layer are codec-related standards such as IS-95, H.324M, H.323 and T.120. A physical layer, which performs channel coding, PN spreading and modulation, includes a layer where air interfacing is performed. A media access control (MAC) layer or a MUX_sublayer has a signaling portion and includes a radio link protocol (RLP) layer or a radio link control (RLC) protocol layer, where a payload received from a radio path is converted into an input format used in the physical layer. Among the three layers, the physical layer is realized in hardware, so becomes less flexible since it has been determined by the standard. However, the user layer can provide flexibility in terms of its network-independent characteristics.

FIG. 2 is a block diagram for explaining framing performed in an RLP layer. If there are N applications such as a first application, a second application, ... and an N-th application, N RLPs, that is, a first RLP layer, a second RLP layer, ... , an N-th RLP layer, are provided. The RLP layers are connected to a physical layer via a MUX and QoS (Quality of Service) sub-layer. FIG. 3 illustrates the formation of a service data unit (SDU) for the

physical layer, which is performed in the RLP layer. In this process, a packet data unit (PDU) of an application layer (for example, an H.223 MUX_PDU in the case of an H.323M standard, and a packet data unit for H.225 in the case of an H.233 standard) is rarely completely aligned within a 5, 10 or 20 msec window without insertion of overhead. Accordingly, there are three cases shown in FIGS. 4A through 4C.

FIG. 4A refers to a case where an application layer data unit (PDU) is aligned within a physical layer SDU. Referring to FIG. 4A, in this case, overhead may be increased due to the excessive number of fill bits. FIG. 4B refers to a case where two or more application layer data units (PDUs) are aligned within a physical layer SDU. In this case, if synchronization points or the information on the length of a data unit (PDU) of an application layer is damaged, detection of the synchronization point for the second or consecutive application layer data units (PDUs) in the physical layer SDU is not guaranteed. FIG. 4C refers to a case where a data unit (PDU) of an application layer is aligned within two or more physical layer SDUs. In this case, there is a case where we cannot know which portion the data unit (PDU) of an application layer is segmented at.

FIG. 5 shows the structure of an RLP frame to explain problems caused upon RLP framing. In the RLP frame structure shown in FIG. 5, the overall length of a payload including an information field is variable. For example, if the information field is not completely filled with information bits, the empty portion of the information field and the remaining empty portion of the RLP frame are filled with fill bits. Thus, the total length of an RLP frame is fixed. However, if the length field is damaged, the exact length of the information field cannot be ascertained, thus generating serious errors.

Disclosure of the Invention

An object of the present invention is to provide an encoding method by which overhead is reduced, and error robustness is increased, so that the

transceiving of multimedia data including video data can be performed more reliably and efficiently in a radio environment.

Another object of the present invention is to provide an encoding device which performs the encoding method.

Still another object of the present invention is to provide a method of decoding frame data which has been encoded by the encoding method.

Yet another object of the present invention is to provide a decoding device which performs the decoding method.

To achieve the first object of the present invention, an encoding method for transceiving multimedia data including video data in a wireless environment, according to an aspect of the present invention, includes: (a) generating a length field representing the number of bits of an information field; (b) generating an error correction code by performing error correction coding with respect to the length field; and (c) inserting the length field and the error correction code during radio link protocol (RLP) framing.

The encoding method further includes (a-1) generating a null indication field indicating the existence of only null data, if only null data exists without information data. Preferably, the step (b) includes generating an error correction code by performing error correction coding with respect to the length field and the null indication field.

Preferably, the step (c) further includes performing RLP framing for a fixed-length RLP frame and inserting a series of fill bits having a constant binary value during the RLP framing to achieve byte alignment to complete the fixed length. Alternatively, in the step (c), RLP framing for a variable-length RLP frame is performed, and the insertion of fill bits may not be performed.

It is also preferable that the error correction coding in the step (b) is Golay coding, and the error correction code is a Golay code which is generated by the Golay coding.

To achieve the first object of the present invention, an encoding method for transceiving multimedia data including video data under a wireless environment, according to another aspect of the present invention, includes:

(a) generating an information field which is video data comprised of a data unit of an application layer; (b) generating a length field representing the number of bits of the information field; (c) generating an error correction code by performing error correction coding with respect to the length field; and (d) inserting the fields and the error correction code in the course of forming a physical layer service data unit (SDU).

To achieve the first object of the present invention, an encoding method for transceiving multimedia data including video data under a wireless environment, according to still another aspect of the present invention, includes: (a) generating a plurality of information fields which are a plurality of application layer data units that can fit into a predetermined window; (b) generating a length field representing the sum of the number of bits in each of the plurality of information fields; (c) generating an error correction code by performing error correction coding with respect to the length field; and (d) inserting the fields and the error correction code in the course of forming a physical layer service data unit (SDU).

To achieve the first object of the present invention, an encoding method for transceiving multimedia data including video data under a wireless environment, according to yet another aspect of the present invention, includes: (a) estimating the state of a channel; if it is determined in step (a) that the value of the state of a channel is at or below a predetermined reference value; (a-1) generating an information field which is video data comprised of an application layer data unit (PDU); (b-1) generating a length field representing the number of bits in the information field; (c-1) generating an error correction code by performing error correction coding with respect to the length field; and (d-1) inserting the fields and the error correction code in the course of forming a physical layer service data unit (SDU), if it is determined in step (a) that the value of the state of a channel is above the predetermined reference value, (a-2) generating a plurality of information fields which are a plurality of application layer data units (PDUs) which can fit into a predetermined window; (b-2) generating a length field representing the

sum of the number of bits in each of the plurality of information fields; (c-2) generating an error correction code by performing error correction coding with respect to the length field; and (d-2) inserting the fields and the error correction code in the course of forming a physical layer service data unit (SDU).

To achieve the second object of the present invention, an encoding device for wireless transceiving of multimedia data including video data, according to an aspect of the present invention, includes: a length field generator for generating a length field representing the number of bits of an RLP payload; a null indication field generator for generating a null indication field; an error correction coding unit for generating an error correction code by performing error correction coding with respect to the length field and the null indication field; and a radio link protocol (RLP) framing unit for performing RLP framing and inserting the length field, the null indication field, and the error correction code in the course of RLP framing.

To achieve the second object of the present invention, an encoding device for wireless transceiving of multimedia data including video data, according to another aspect of the present invention, includes: an information field generator for generating an information field having an amount of video data that fits into a window having a predetermined length; a length field generator for generating a length field representing the number of bits of an RLP payload; an error correction coding unit for generating an error correction code by performing error correction coding with respect to the length field; and a framing unit for inserting the fields and the error correction code in the course of forming a physical layer service data unit (SDU).

To achieve the second object of the present invention, an encoding device for wireless transceiving of multimedia data including video data, according to still another aspect of the present invention, includes: a channel state estimator for estimating the state of a channel, and outputting a control signal having a first logic if the value of the state of a channel is at or below a predetermined reference value, and outputting a control signal having a

second logic if the value of the state of a channel is above the predetermined reference value; an information field generator for generating an information field which is video data comprised of an application layer data unit (PDU) in response to the control signal having the first logic, and generating a plurality of information fields which are a plurality of application layer data units (PDUs) that can fit into a predetermined window; a length field generator for generating a length field representing the number of bits of an RLP payload; an error correction coding unit for generating an error correction code by performing error correction coding with respect to the length field; and a framing unit for inserting the fields and the error correction code in the course of forming a physical layer SDU.

To achieve the third object of the present invention, there is provided a method of receiving and decoding frame data encoded by an encoding method including generating a first length field representing the number of bits of an information field, generating an error correction code by performing error correction coding with respect to the first length field, and inserting the first length field and the error correction code in the course of framing. This method includes: (a) restoring from the frame data the first length field representing the length of the information field; (b) restoring a second length field representing the number of bits of the information region by decoding the error correction code; (c) setting the second length field as a length field if there is an error in the first length field, and otherwise, setting the first length field as a length field; and (d) performing decoding with reference to a set length field.

The decoding method further includes: (e) restoring a null indication field representing that the information field is filled with null bits; and (f) determining whether the null indication field represents that the frame is filled with only null bits. It is preferable that if it is determined in step (f) that the null indication field represents that the frame is filled with only null bits, even if "1" is generated in a fill bit region, "1" is not regarded as an information bit.

To achieve the fourth object of the present invention, there is provided a device for receiving and decoding frame data encoded by an encoding device including a length field generator for generating a first length field representing the number of bits of an information field, an error correction coding unit for generating an error correction code by performing error correction coding with respect to the first length field, and a framing unit for performing framing and inserting the first length field and the error correction code in the course of framing. The decoding device includes: an unframing unit for restoring the first length field representing the length of the information field from received service data unit (SDU) frame data, and outputting an error signal having a first logic level for indicating the existence of an error upon restoring the first length field, if an error is generated; an error correction code decoder for restoring a second length field representing the number of bits of the information region by decoding the error correction code; a length field setting unit for setting the second length field as a length field in response to the error signal having the first logic level and outputting the second length field to the unframing unit, and setting the first length field as a length field in response to an error signal having a second logic level and outputting the first length field to the unframing unit; and a decoding unit for decoding the restored information field to output video data.

Brief Description of the Drawings

FIG. 1 is a view showing the layer structure of a general wireless transceiving device;

FIG. 2 is a block diagram illustrating framing performed in a radio link protocol (RLP) layer in the layer structure of FIG. 1;

FIG. 3 is a view illustrating the formation of a service data unit (SDU) for a physical layer with data of an application layer in the layer structure of FIG. 1, which is performed in an RLP layer;

FIG. 4A is a view illustrating a case where an application layer data unit is aligned within a physical layer SDU;

FIG. 4B is a view illustrating a case where two or more application layer data units are aligned within a physical layer SDU;

FIG. 4C is a view illustrating a case where an application layer data unit is aligned within two or more physical layer SDUs;

FIG. 5 is a view showing the structure of an RLP frame to explain problems caused upon RLP framing;

FIG. 6 is a flowchart illustrating the essential steps in an encoding method according to a first embodiment of the present invention;

FIG. 7A is a view showing the structure of a frame formed by the encoding method according to the first embodiment of the present invention described with reference to FIG. 6;

FIG. 7B is a view showing the structure of a frame formed by an encoding method according to a second embodiment of the present invention;

FIG. 7C is a view illustrating the formation of a physical layer SDU (service data unit) using an encoding method according to a third embodiment of the present invention;

FIG. 7D is a view illustrating the formation of a physical layer SDU using an encoding method according to a fourth embodiment of the present invention;

FIG. 7E is a view illustrating the formation of a physical layer SDU using an encoding method according to a fifth embodiment of the present invention;

FIG. 7F is a view illustrating the formation of a physical layer SDU using an encoding method according to a sixth embodiment of the present invention;

FIG. 8 is a block diagram of an encoding device according to the present invention;

FIG. 9 is a flowchart illustrating a decoding method according to the present invention; and

FIG. 10 is a block diagram of a decoding device according to the present invention.

Best mode for carrying out the Invention

An encoding method according to a first embodiment of the present invention shown in FIG. 6 is applied to radio link protocol (RLP) framing to form an RLP frame having a fixed length. Referring to FIG. 6, in the encoding method of the present invention, a length field representing the number of bits constituting an information field is generated, in step 600. Here, the number of bits of an information field is variable, and can be understood to denote the length of a payload. Then, when no information bits exist except null data, a null indication field which indicates that no information bits exist except null data is generated, in step 602. Next, a Golay code, which is an error correction code, is formed by performing Golay coding, which is an error correction coding method, with respect to the length field and the null indication field, in step 604. Following this, the length field, the null indication field, and the Golay code are inserted in the course of forming an RLP frame, in step 606. Thereafter, in this embodiment, an empty portion of the RLP frame is filled with fill bits for achieving byte alignment.

FIG. 7A is a block diagram of the structure of a frame formed by the encoding method according to the first embodiment described with reference to FIG. 6. Here, the frame includes a length field representing the number of information bits of an information field, and a null indication field representing that the frame has no information bits and that the frame is filled with "0". The frame also includes a Golay code produced by Golay coding the length field and the null indication field in step 604. Also, the bits are inserted into the frame.

Upon decoding the frame encoded by the encoding method described above, the length field representing the number of information bits, and the null indication field representing that an empty portion of the frame is filled with "0", are decoded. Thus, when the null indication field represents that the frame is filled with only "0", even if "1" is generated in the fill bit region due to an error, "1" is not regarded as an information bit.

The length field and the null indication field are protected from errors by the Golay code. Hence, when Golay decoding of the Golay code is performed upon decoding, the length field and the null indication field can be restored by error correction even if the inserted length field and null indication field are damaged.

An encoding method according to a second embodiment of the present invention can be applied to RLP framing to form an RLP frame having a variable length. In the second embodiment, the steps 600, 602, 604 and 606 in the first embodiment of FIG. 6 are performed, but fill bits are not inserted since a variable bit rate is allowed. FIG. 7B shows the structure of a frame formed by the encoding method according to the second embodiment. It becomes evident from FIG. 7B that the frame formed by the encoding method according to the second embodiment includes no fill bit regions, which correspond to overhead. Therefore, the bit rate efficiency can be improved.

In the above two embodiments, encoding using RLP framing is performed. However, transparent transmission of video information due to a reduction in redundancy or overhead information is required in some cases. It is preferable that these cases use encoding methods according to embodiments to be described below.

An encoding method according to a third embodiment of the present invention can be applied to the case where an application layer data unit (for example, an H.223 MUX_PDU in the case of an H.324M standard, and a packet data unit for H.225 in the case of an H.323 standard) is aligned with a physical layer SDU without performing RLP framing. In this embodiment, first, an information field for video data comprised of an application layer data unit, for example, an H.223 MUX_PDU, is generated. Then, a length field representing the length of the application layer data unit is generated. Following this, a Golay code is generated by Golay coding the length field.

The generated fields and code are inserted within a physical layer SDU. In the third embodiment, the length field is inserted after a MUX header, and a marker having uniqueness and a predetermined length is inserted between

the information field and a fill bit region. Referring to FIG. 7C, which illustrates a process for forming a physical layer SDU using the encoding method according to the third embodiment, it can be seen that an application layer data unit, for example, an H.223 MUX_PDU, is aligned within a physical layer SDU. According to the third embodiment, the physical layer SDU has no overhead, which is generated upon RLP framing. The length of data generated in a user layer is almost the same as the length of a physical layer SDU. Also, a predetermined window, for example, a 5, 10 or 20 msec window, is filled by inserting fill bits, and a marker is placed in front of the fill bit region filled with null data "0".

Upon decoding the encoded frame according to the third embodiment, the length field is protected from errors by a Golay code, thus increasing the reliability with respect to the length of the information field. Also, the third embodiment does not use RLP framing while protecting the length of the application layer data unit (PDU), so that overhead can be reduced while error resilience increases. Furthermore, the marker inserted between the information field and the fill bit region can be detected upon decoding since it is unique, so that error robustness is further increased.

An encoding method according to a fourth embodiment of the present invention can be applied to the case where at least two application layer data units (PDUs) are aligned within a physical layer SDU without performing RLP framing. Referring to FIG. 7D, which illustrates the formation of a physical layer SDU using the encoding method according to the fourth embodiment, a plurality of information fields, which are a plurality of application layer data units (PDUs) that can be inserted within a 20 msec window, are generated. Next, a length field representing the sum of the number of bits constituting each of the plurality of information fields is generated. Here, the number of bits of an information field is variable, and can be understood to denote the length of a payload. Following this, a Golay code is generated by Golay coding the length field.

The generated length field and Golay code are inserted within a physical layer SDU in the course of forming a physical layer SDU. In this embodiment, the length field is inserted after a MUX header, and an application layer data unit (PDU) is inserted instead that the fill bit region and the marker field described with reference to FIG. 7C are inserted.

Referring to FIG. 7D, it becomes evident that two complete application layer data units (PDUs) and part of an application layer data unit (PDU) are aligned within a physical layer SDU. According to the fourth embodiment, it is possible to reduce overhead, which is caused upon RLP framing, and data generated in a user layer is continuously inserted to complete the length of the physical layer SDU.

The encoded frames according to the third and fourth embodiments have a reduced amount of overhead since RLP framing is not used. Also, the encoding methods according to the third and fourth embodiments can be selectively used when the state of a channel is good and video data is required to be transmitted at a fast transmission rate.

Although embodiments which do not use RLP framing are described above, the following embodiments can use RLP framing as described below.

FIG. 7E illustrates the formation of a physical layer SDU using an encoding method according to a fifth embodiment of the present invention. The encoding method according to the fifth embodiment can be applied to the case where an application layer data unit (PDU) is aligned within a physical layer SDU with RLP framing. Here, an application layer data unit (PDU) does not necessarily include all the data between the synchronization point of an application layer data unit (PDU) and the synchronization point of the next application layer data unit (PDU). In the fifth embodiment, video data corresponding to an application layer data unit (PDU) is converted into an RLP frame by RLP framing. During RLP framing, a length field representing the length of an application layer data unit (PDU) is generated, and a Golay code is generated by Golay coding the length field. The RLP frame has an RLP header field into which the length field and the Golay code field are included.

Then, a MUX header, the RLP frame, and a fill bit region constitute a physical layer SDU.

Upon decoding the encoded frame according to the fifth embodiment, the reliability of the length of an information field is increased since the length field is protected from errors by the Golay code. Also, the length information of the application layer data unit (PDU) is protected, so that error robustness is increased.

FIG. 7F illustrates the formation of a physical layer SDU using an encoding method according to a sixth embodiment of the present invention. The encoding method according to the sixth embodiment is applied to the case where at least two application layer data units (PDUs) are aligned within a physical layer SDU with RLP framing. Here, an application layer data unit (PDU) does not necessarily include all the data between the synchronization point of an application layer data unit (PDU) and the synchronization point of the next application layer data unit (PDU). In the sixth embodiment, video data corresponding to two application layer data units (PDUs) and part of an application layer data unit (PDU) are converted into RLP frames by RLP framing. During RLP framing, an RLP header is added to the header of each application layer data unit (PDU), a length field representing the length of an application layer data unit (PDU) is generated, and a Golay code is generated by Golay coding the length field. The RLP frames include RLP header fields into each of which the length field and the Golay code field are inserted. Then, a MUX header, two complete RLP frames and part of an RLP frame, and a fill bit region constitute a physical layer SDU.

Upon decoding the encoded frame according to the sixth embodiment, the reliability of the length of an information field is increased since the length field is protected from errors by the Golay code. That is, the length of the application layer data unit (PDU) is protected, so that error robustness is increased.

Referring to FIG. 8, which is a block diagram of an encoding device according to an embodiment of the present invention, the encoding device

includes a channel state estimator 800, an information field generator 802, a length field generator 804, a Golay coding unit, and a framing unit 808. The channel state estimator 800 estimates the state of a channel using received channel state information and outputs a high level control signal CONTROL if the value of the channel state is at or below a predetermined reference value, and a low level control signal CONTROL if the value of the channel state is above the predetermined reference value. The channel state information is obtained from a back channel.

The information field generator 802 generates an information field INFORMATION, which is video data comprised of an application layer data unit (PDU), in response to the high level control signal CONTROL, and a plurality of information fields, which are a plurality of application layer data unit (PDU) that can be inserted within a predetermined window, in response to the low level control signal CONTROL. The length field generator 804 generates a length field representing the number of bits of an information field. It is preferable that the encoding device further includes a null indication field generator (not shown) for generating a null indication field.

The Golay coding unit 806 performs Golay coding, which is a type of error correction coding, with respect to the length field and the null indication field, to generate a Golay code. The framing unit 808 performs RLP framing and simultaneously inserts the information field, the length field, and the Golay code into an SDU frame.

In this embodiment, the framing unit 808 includes a fill bit insertion unit 810 and a marker insertion unit 812. The fill bit insertion unit 810 inserts a series of fill bits having a constant binary value to achieve byte alignment, while performing the RLP framing for a fixed-length RLP frame. The marker insertion unit 812 inserts a marker which has uniqueness and a predetermined length. Alternatively, the framing unit 808 can performs the RLP framing for a variable length RLP frame, and thus does not need to insert fill bits during the RLP framing. In this way, the framing unit 808 outputs a physical layer

SDU frame. The length field within the physical layer SDU frame is protected from errors by the Golay code.

The important points in the above-described embodiments will now be indicated.

According to an aspect of the present invention, a length field representing the length of a payload is inserted when data packetizing is performed in the layer between an application layer and a physical layer. The layer between an application layer and a physical layer may be a radio link protocol (RLP) layer or radio link control (RLC) protocol layer, which packetizes data descending from the application layer and/or depacketizing data ascending thereto. Alternatively, the layer between an application layer and a physical layer may be a MUX_sublayer or medium access control (MAC) layer, which packetizes data descending to the physical layer and/or depacketizing data ascending therefrom.

According to another aspect of the present invention, a variable-length data unit is generated when data packetizing is performed in the layer between an application layer and a physical layer. Also, preferably, a length field representing the length of a payload including the data unit is inserted. The layer between an application layer and a physical layer may be a radio link protocol (RLP) layer or radio link control (RLC) protocol layer, which packetizes data descending from the application layer and/or depacketizing data ascending thereto. Furthermore, it is more preferable that fill bits and the length field representing the length of a payload including the data unit are inserted.

According to still another aspect of the present invention, a data unit generated in the application layer is aligned within a data unit generated in a physical layer below the application layer, when data packetizing is performed in the layer between the application layer and the physical layer.

According to yet another aspect of the present invention, when a layer, which packetizes data descending to the physical layer and/or depacketizing data ascending therefrom, is set to be a first layer, and a layer, which

packetizes data descending from the application layer and/or depacketizing data ascending thereto, is set to be a second layer, a data unit generated in the second layer is aligned within a data unit generated in the first layer while data packetizing is performed in the layer between the application layer and the physical layer. Here, preferably, the first layer is a MUX_sublayer or an MAC layer, and the second layer is an RLP layer or an RLC protocol layer.

According to the encoding methods of the embodiments of the present invention, data is aligned to generate a variable length data unit while being packetized in a layer between an application layer and a physical layer, and a length field representing the length of a payload is inserted. Therefore, error resilience is increased, and also overhead can be reduced.

Frame data encoded by the above encoding methods is decoded by a decoding method according to the present invention. That is, in order to transceive multimedia, data is encoded by a multimedia data encoding method including inserting a length field representing the length of a payload while data is packetized in the layer between an application layer and a physical layer, and the encoded data is decoded with reference to the length field when the length field is added to the encoded data.

Also, in order to transceive multimedia data, a variable length data unit is encoded by a multimedia data encoding method including (a) generating a variable length data unit while data is packetized in the layer between an application layer and a physical layer, and the encoded variable length data unit can be decoded by a similar method to a conventional decoding method. When the variable length data unit is encoded by a multimedia data encoding method which further includes (b) inserting a length field representing the length of a payload including the data unit, after the step (a), it can be decoded with reference to the length field.

Also, in order to transceive multimedia data, a data unit of a layer below the application layer is encoded by a multimedia data encoding method including (a) aligning a data unit generated in the application layer within a data unit of the layer below the application layer while data is packetized in

the layer between the application layer and a physical layer, and the encoded data unit can be decoded by a similar method to a conventional decoding method. When the step (a) is a step of aligning a data unit generated in the application layer, and a data unit to which a length field representing the length of a payload including the data unit is added, within a data unit of the layer below the application layer while data is packetized in the layer between the application layer and a physical layer, the encoded data unit of the layer below the application layer can be decoded with reference to the length field.

Also, in order to transceive multimedia data, when a layer, which packetizes data descending to the physical layer and/or depacketizing data ascending therefrom, is set to be a first layer, and a layer, which packetizes data descending from the application layer and/or depacketizing data ascending thereto, is set to be a second layer, a data unit generated in the first layer is encoded by a multimedia data encoding method including (a) aligning a data unit generated in the second layer within a data unit generated in the first layer while data packetizing is performed in the layer between the application layer and the physical layer. Then, the encoded data unit can be decoded by a similar method to a conventional decoding method. When the step (a) is a step of aligning a data unit generated in the second layer, and a data unit to which a length field representing the length of a payload including the data unit is added, within a data unit of the first layer while data is packetized in the layer between the application layer and a physical layer, the encoded data unit of the first layer can be decoded with reference to the length field. Also, when the step (a) is a step of aligning a data unit generated in the second layer, and a data unit to which fill bits and a length field representing the length of a payload including the data unit are added, within a data unit of the first layer while data is packetized in the layer between the application layer and the physical layer, the encoded data unit of the first layer can be decoded with reference to the length field.

Also, in order to transceive multimedia data, when a layer, which packetizes data descending to the physical layer and/or depacketizing data

ascending therefrom, is set to be a first layer, and a layer, which packetizes data descending from the application layer and/or depacketizing data ascending thereto, is set to be a second layer, a data unit of the physical layer is encoded by a multimedia data encoding method including (a) aligning a data unit generated in the first layer within the data unit of the physical layer while data packetizing is performed in the layer between the application layer and the physical layer. Then, the encoded physical layer data unit can be decoded by a similar method to a conventional decoding method. When the step (a) is a step of aligning a data unit generated in the first layer, and a data unit to which a length field representing the length of a payload including the data unit is added, within a physical layer data unit while data is packetized in the layer between the application layer and the physical layer, the encoded physical layer data unit can be decoded with reference to the length field.

Also, in order to transceive multimedia data, when a layer, which packetizes data descending to the physical layer and/or depacketizing data ascending therefrom, is set to be a first layer, and a layer, which packetizes data descending from the application layer and/or depacketizing data ascending thereto, is set to be a second layer, a physical layer data unit is encoded by a multimedia data encoding method including: aligning a data unit generated in the second layer within a data unit generated in the first layer; and aligning a data unit generated in the first layer within a physical layer data unit, while data packetizing is performed in the layer between the application layer and the physical layer. Then, the encoded physical layer data unit can be decoded by a similar method to a conventional decoding method.

Referring to FIG. 9, which is a flowchart illustrating a decoding method according to the most preferable embodiment of the present invention, first, SDU frame data which has been encoded by the above encoding methods or an encoding device for performing the encoding methods is received, in step 900. Next, a first length field is restored from the SDU frame data, in step 902. Then, a second length field representing the number of bits of an information field is restored by decoding a Golay code, in step 904.

Following this, it is determined whether the first length field has errors, in step 906. If it is determined that the first length field has errors, the second length field is set as a length field, in step 908. Otherwise, the first length field is set as a length field, in step 910. Thereafter, decoding is performed with reference to the set length field, which is not shown.

In the first embodiment, the information field can be filled with null data. Hence, in the decoding process, a null indication field representing whether the information field is filled with null bits is restored, in step 912. Then, it is determined whether the null indication field represents that a corresponding frame is filled with only null bits "0", in step 914. If the null indication field represents that a corresponding frame is filled with only null bits "0", even if "1" is detected in the fill bit region, "1" is not regarded as an information bit, in step 916.

Also, it is preferable that the decoding method further includes the step (not shown) of detecting a marker having uniqueness inserted between the information field and the fill bit region, when an encoding method is a method for forming a physical layer SDU without using RLP framing.

According to the decoding method of the present invention described above, information on the length of an information field can be restored even if a length field is damaged, since the length field has been protected from errors by a Golay code. That is, the capability of restoring information on the length of an application layer data unit is increased, which increases error robustness.

Referring to FIG. 10, which is a block diagram of a decoding device according to an embodiment of the present invdntion, the decoding device includes an unframing unit 1002, a Golay code decoder 1004, a length field setting unit 1006, and a decoding unit 1008.

The unframing unit 1002 restores a first length field **length_1**, which represents the length of an information field, and a Golay code from a received SDU frame. If an error occurs when the first length field **length_1** is restored, the unframing unit 1002 outputs a high level error signal

length_1_error which indicates that an error occurred when the first length field **length_1** was restored. The Golay code decoder 1004 decodes a Golay code to restore a second length field **length_2** which represents the number of bits of an information field. The length field setting unit 1006 sets the second length field **length_2** as a length field in response to the high level error signal **length_1_error** and outputs the set length field to the unframing unit 1002. On the other hand, if the error signal **length_1_error** is not high, the length field setting unit 1006 sets the first length field **length_1** as a length field and outputs the set length field to the unframing unit 1002. The unframing unit 1002 extracts information bits with reference to the length field representing the length of an information field. The decoding unit 1008 decodes the restored information bits to output video data.

The encoding methods and the decoding method according to the present invention described above can be written as computer programs. These programs can be stored in a computer readable recording medium. The recording medium includes magnetic recording media such as floppy disks or hard discs, and optical recording media such as CD-ROMs or DVDs. Also, these programs can be transmitted via a carrier wave such as Internet. Each of the programs includes a code and code segments which can be easily inferred by the programmers of the technical field to which the present invention pertains. The encoding methods and the decoding method according to the present invention can be realized within general-use digital computers by reading the programs from computer readable recording media and operating the read programs.

<u>Industrial Applicability</u>

As described above, the encoding methods according to the present invention reduce overhead when multimedia data including video data is transmitted and received under the radio environment, and increase error robustness, thereby improving the quality of an image.

What is claimed is:

1. A method of encoding multimedia data including video data, comprising:

(a) generating a length field representing the number of bits of an information field;

(b) generating an error correction code by performing error correction coding with respect to the length field; and

(c) inserting the length field and the error correction code during radio link protocol (RLP) framing.

2. The encoding method of claim 1, further comprising (a-1) generating a null indication field indicating the existence of only null data, if only null data exists in the information field,

wherein the step (b) comprises generating an error correction code by performing error correction coding with respect to the length field and the null indication field.

3. The encoding method of claim 1, wherein the step (c) further comprises performing RLP framing for a fixed-length RLP frame and inserting a series of fill bits having a constant binary value during the RLP framing to achieve byte alignment to complete the fixed length.

4. The encoding method of claim 1, wherein in the step (c), RLP framing for a variable-length RLP frame is performed, and the insertion of fill bits is not performed.

5. The encoding method of any of claims 1 through 4, wherein the error correction coding in the step (b) is Golay coding, and the error correction code is a Golay code which is generated by the Golay coding.

6. A method of encoding multimedia data including video data, comprising:

(a) generating an information field which is video data comprised of an application layer data unit;

(b) generating a length field representing the number of bits of the information field;

(c) generating an error correction code by performing error correction coding with respect to the length field; and

(d) inserting the fields and the error correction code in the course of forming a physical layer service data unit (SDU).

7. The encoding method of claim 6, further comprising (e) inserting fill bits to complete a window having a predetermined length.

8. The encoding method of claim 7, wherein in the step (e), the predetermined length of the window is 20 msec, and fill bits having a predetermined binary value are inserted to complete the 20 msec length of the window.

9. The encoding method of any of claim 6 through 8, further comprising inserting a marker which has uniqueness and a predetermined length, between the information field and the fill bit region.

10. The encoding method of claim 6, wherein the length field is inserted to the rear of a MUX header.

11. An encoding method for wireless transceiving of multimedia data including video data, comprising:

(a) generating a plurality of information fields depending on the number of application layer data units that can fit into a predetermined window;

(b) generating a length field representing the sum of the number of bits in each of the plurality of information fields;

(c) generating an error correction code by performing error correction coding with respect to the length field; and

(d) inserting the fields and the error correction code in the course of aligning an application layer data unit and an RLP unit within a physical layer service data unit (SDU).

12. The encoding method of claim 11, wherein the application layer data unit is an H.223 MUX_PDU in the case of an H.324M standard, or a packet data unit, which satisfies an H.225 standard, in the case of an H.323 standard.

13. A method of encoding multimedia data including video data, comprising:

(a) estimating the state of a channel;

if it is determined in step (a) that the value of the state of a channel is at or below a predetermined reference value;

(a-1) generating an information field which is video data comprised of an application layer data unit;

(b-1) generating a length field representing the number of bits in the information field;

(c-1) generating an error correction code by performing error correction coding with respect to the length field; and

(d-1) inserting the fields and the errror correction code in the course of aligning an application layer data unit and an RLP unit within a physical layer service data unit (SDU),

if it is determined in step (a) that the value of the state of a channel is above the predetermined reference value,

(a-2) generating a plurality of information fields which are a plurality of application layer data units which can fit into a predetermined window;

(b-2) generating a length field representing the sum of the number of bits in each of the plurality of information fields;

(c-2) generating an error correction code by performing error correction coding with respect to the length field; and

(d-2) inserting the fields and the error correction code in the course of aligning an application layer data unit and an RLP unit within a physical layer service data unit (SDU).

14. The encoding method of claim 13, wherein the application layer data unit is an H.223 MUX_PDU in the case of an H.324M standard or a packet data unit, which satisfies an H.225 standard, in the case of an H.323 standard.

15. An encoding device for wireless transceiving of multimedia data, comprising:

a length field generator for generating a length field representing the number of bits of an RLP payload;

a null indication field generator for generating a null indication field;

an error correction coding unit for generating an error correction code by performing error correction coding with respect to the length field and the null indication field; and

an RLP framing unit for performing RLP framing and inserting the length field, the null indication field, and the error correction dode in the course of RLP framing.

16. The encoding device of claim 15, wherein the RLP framing unit further comprises a fill bit insertion unit for performing RLP framing for a fixed-length RLP frame and inserting a series of fill bits having a constant binary value during the RLP framing to achieve byte alignment to complete the fixed length.

17. The encoding device of claim 15, wherein in the RLP framing unit, RLP framing for a variable-length RLP frame is performed, and the insertion of fill bits is not performed.

18. The encoding device of any of claims 15 through 17, wherein the error correction coding unit performs Golay coding, and the error correction code is a Golay code which is generated by the Golay coding.

19. An encoding device for wireless transceiving of multimedia data, comprising:

an information field generator for generating an information field having an amount of video data that fits into a window having a predetermined length;

a length field generator for generating a length field representing the number of bits of an RLP payload;

an error correction coding unit for generating an error correction code by performing error correction coding with respect to the length field; and

a framing unit for inserting the fields and the error correction code in the course of forming a physical layer service data unit (SDU).

20. The encoding device of claim 19, further comprising a fill bit insertion unit for inserting fill bits to achieve byte alignment to complete a window having a predetermined length.

21. The encoding device of claim 19 or 20, further comprising a marker insertion unit for inserting a marker which has uniqueness and a predetermined length, between the information field and the fill bit field.

22. An encoding device for wireless transceiving of multimedia data including video data, comprising:

a channel state estimator for estimating the state of a channel, and outputting a control signal having a first logic if the value of the state of a

channel is at or below a predetermined reference value, and outputting a control signal having a second logic if the value of the state of a channel is above the predetermined reference value;

an information field generator for generating an information field which is video data comprised of an application layer data unit in response to the control signal having the first logic, and generating a plurality of information fields which are a plurality of application layer data units that can fit into a predetermined window;

a length field generator for generating a length field representing the number of bits of an RLP payload;

an error correction coding unit for generating an error correction code by performing error correction coding with respect to the length field; and

a framing unit for inserting the fields and the error correction code in the course of forming a physical layer SDU.

23. The encoding device of claim 22, wherein the application layer data unit is an H.223 MUX_PDU in the case of an H.324M standard or a packet data unit, which satisfies an H.225 standard, in the case of an H.323 standard.

24. The encoding device of claim 22, wherein the framing unit performs RLP framing for a fixed-length RLP frame and inserts the length field, the null indication field, and the error correction code during the RLP framing for a fixed-length RLP framing, and further comprises a fill bit insertion unit for inserting a series of fill bits having a constant logic during the RLP framing to achieve byte alignment to complete the fixed length.

25. The encoding device of claim 22, wherein in the framing unit, RLP framing for a variable-length RLP frame is performed, and the insertion of fill bits is not performed.

26. A method of receiving and decoding frame data encoded by an encoding method including generating a first length field representing the number of bits of an informatiom field, generating an error correction code by performing error correction coding with respect to the first length field, and inserting the first length field and the error correction code in the course of framing, the method comprising:

(a) restoring from the frame data the first length field representing the length of the information field;

(b) restoring a second length field representing the number of bits of the information region by decoding the error correction code;

(c) setting the second length field as a length field if there is an error in the first length field, and otherwise, setting the first length field as a length field; and

(d) performing decoding with reference to a set length field.

27. The decoding method of claim 26, further comprising:

(e) restoring a null indication field representing that the information field is filled with null bits; and

(f) determining whether the null indication field represents that the frame is filled with only null bits,

wherein if it is determined in step (f) that the null indication field represents that the frame is filled with only null bits, even if "1" is generated in a fill bit region, "1" is not regarded as an information bit.

28. The decoding method of claim 26, wherein the framing process is a radio link protocol (RLP) framing process.

29. The decoding method of claim 26, wherein the framing process is a method of forming a physical layer SDU without using RLP framing, and further comprising (f) inserting a marker which has uniqueness, between the information field and the fill bit region.

30. A device for receiving and decoding frame data encoded by an encoding device including a length field generator for generating a first length field representing the number of bits of an information field, an error correction coding unit for generating an error correction code by performing error correction coding with respect to the first length field, and a framing unit for performing framing and inserting the first length field and the error correction code in the course of framing, the device comprising:

an unframing unit for restoring the first length field representing the length of the information field from received service data unit (SDU) frame data, and outputting an error signal having a first logic level for indicating the existence of an error upon restoring the first length field, if an error is generated;

an error correction code decoder for restoring a second length field representing the number of bits of the information region by decoding the error correction code;

a length field setting unit for setting the second length field as a length field in response to the error signal having the first logic level and outputting the second length field to the unframing unit, and setting the first length field as a length field in response to an error signal having a second logic level and outputting the first length field to the unframing unit; and

a decoding unit for decoding the restored information field to output video data.

31. The decoding device of claim 30, wherein the error correction coding is Golay coding, and the error correction code is a Golay code.

32. A method of packetizing multimedia data to transmit multimedia data, comprising (a) generating a length field representing the overall length of a payload while data packetizing is performed in the layer between an application layer and a physical layer.

33. The method of claim 32, wherein the layer between an application layer and a physical layer is an RLP layer or a radio link control (RLC) protocol layer, which packetizes data transferred from the application layer.

34. The method of claim 32, wherein the layer between an application layer and a physical layer is a MUX_sublayer or a medium access control (MAC) layer, which packetizes data transferred from the physical layer.

35. A method of packetizing multimedia data to transmit multimedia data, comprising (a) generating a variable length data unit while data packetizing is performed in the layer between an application layer and a physical layer.

36. The method of claim 35, after the step (a), further comprising (b) generating a length field representing the length of a payload including the data unit.

37. The method of claim 35, wherein the layer between an application layer and a physical layer is an RLP layer or a radio link control (RLC) protocol layer, which packetizes data transferred from the application layer.

40. The method of claim 35, wherein the layer between an application layer and a physical layer is a MUX_sublayer or a medium access control (MAC) layer, which packetizes data transferred from the physical layer.

41. The method of claim 36, wherein in the step (b), a length field representing the length of a payload including the data unit, and fill bits are inserted.

42. A method of packetizing multimedia data to transmit multimedia data, comprising (a) aligning a data unit generated in the application layer within a data unit of the layer below the application layer while data packetizing is performed in the layer between an application layer and a physical layer.

43. The method of claim 42, wherein the layer between an application layer and a physical layer is an RLP layer or an RLC protocol layer, which packetizes data transferred from the application layer.

44. The method of claim 42, wherein the layer between an application layer and a physical layer is a MUX_sublayer or an MAC layer, which packetizes data transferred from the physical layer.

45. The method of claim 42, wherein the step (a) is a step of aligning a data unit generated in the application layer, and a data unit to which a length field representing the length of a payload including the data unit is added, within a data unit of the layer below the application layer, while data packetizing is performed in the layer between an application layer and a physical layer.

46. The method of claim 42, wherein the step (a) is a step of aligning a data unit generated in the application layer, and a data unit to which at least one fill bit and a length field representing the length of a payload including the data unit are added, within a data unit of the layer below the application layer, and packetizing the data in the layer between an application layer and a physical layer.

47. A method of packetizing multimedia data to transmit multimedia data, comprising a step (a) wherein when a layer, which packetizes data transferred to a physical layer, is set to be a first layer, and a layer, which

packetizes data transferred from an application layer, is set to be a second layer, a data unit generated in the second layer is aligned within the data unit of the first layer while data packetizing is performed in the layer between the application layer and the physical layer.

48. The method of claim 47, wherein the first layer is a MUX_sublayer or an MAC layer.

49. The method of claim 47, wherein the second layer is an RLP layer or an RLC protocol layer.

50. The method of claim 47, wherein in the step (a), when a layer, which packetizes data transferred to a physical layer, is set to be a first layer, and a layer, which packetizes data transferred from an application layer, is set to be a second layer, a data unit generated in the second layer, and a data unit to which a length field representing the length of a payload including the data unit is added are aligned within a data unit of the first layer while data packetizing is performed in the layer between the application layer and the physical layer.

51. The method of claim 50, wherein the first layer is a MUX_sublayer or an MAC layer.

52. The method of claim 50, wherein the second layer is an RLP layer or an RLC protocol layer.

53. The method of claim 47, wherein in the step (a), when a layer, which packetizes data transferred to a physical layer, is set to be a first layer, and a layer, which packetizes data transferred from an application layer, is set to be a second layer, a data unit generated in the second layer, and a data unit to which at least one fill bit and a length field representing the length of

a payload including the data unit are added are aligned within a data unit of the first layer while data packetizing is performed in the layer between the application layer and the physical layer.

54. The method of claim 53, wherein the first layer is a MUX_sublayer or an MAC layer.

55. The method of claim 53, wherein the second layer is an RLP layer or an RLC protocol layer.

56. A method of packetizing multimedia data to transmit multimedia data, comprising a step (a) wherein when a layer, which packetizes data transferred to a physical layer, is set to be a first layer, and a layer, which packetizes data transferred from an application layer, is set to be a second layer, a data unit generated in the first layer is aligned within a data unit of the physical layer while data packetizing is performed in the layer between the application layer and the physical layer.

57. The method of claim 56, wherein the first layer is a MUX_sublayer or an MAC layer.

58. The method of claim 56, wherein in the step (a), when a layer, which packetizes data transferred to a physical layer, is set to be a first layer, and a layer, which packetizes data transferred from an application layer, is set to be a second layer, a data unit generated in the first layer, and a data unit to which a length field representing the length of a payload including the data unit is added, are aligned within a data unit of the physical layer while data packetizing is performed in the layer between the application layer and the physical layer.

59. The method of claim 58, wherein the first layer is a MUX_sublayer or an MAC layer.

60. The method of claim 56, wherein in the step (a), when a layer, which packetizes data transferred to a physical layer, is set to be a first layer, and a layer, which packetizes data transferred from an application layer, is set to be a second layer, a data unit generated in the first layer, and a data unit to which filling bits and a length field representing the length of a payload including the data unit are added, are aligned within a data unit of the physical layer while data packetizing is performed in the layer between the application layer and the physical layer.

61. The method of claim 60, wherein the first layer is a MUX_sublayer or an MAC layer.

62. A method of packetizing multimedia data to transmit multimedia data, in which, when a layer, which packetizes data transferred to a physical layer, is set to be a first layer, and a layer, which packetizes data transferred from an application layer, is set to be a second layer, the method comprises a step (a) of aligning a data unit generated in the second layer within a data unit of the first and aligning a data unit generated in the first layer within a data unit of the physical layer, while data packetizing is performed in the layer between the application layer and the physical layer.

63. The method of claim 62, wherein the first layer is a MUX_sublayer or an MAC layer, and the second layer is an RLP layer or an RLC protocol layer.

64. A method of depacketizing multimedia data to receive multimedia data, comprising (a) receiving data including a length field representing the

length of a payload and depacketizing the data in the layer between an application layer and a physical layer.

65. The method of claim 64, wherein the layer between an application layer and a physical layer is an RLP layer or an RLC protocol layer, which depacketizes data transferred to the application layer.

66. The method of claim 64, wherein the layer between an application layer and a physical layer is a MUX_sublayer or an MAC layer, which depacketizes data transferred from the physical layer.

67. A method of depacketizing multimedia data to receive multimedia data, comprising (a) receiving data including a length field representing the length of a data unit of a variable length and depacketizing the data in the layer between an application layer and a physical layer.

68. The method of claim 67, wherein the layer between an application layer and a physical layer is an RLP layer or an RLC protocol layer, which depacketizes data transferred to the application layer.

69. The method of claim 67, wherein the layer between an application layer and a physical layer is a MUX_sublayer or an MAC layer, which depacketizes data transferred from the physical layer.

70. The method of claim 67, wherein the data includes fill bits.

71. A method of depacketizing multimedia data to receive multimedia data, comprising (a) receiving data aligned within a data unit of the layer below an application layer, and depacketizing the data in the layer between the application layer and a physical layer.

72. The method of claim 71, wherein the layer between an application layer and a physical layer is an RLP layer or an RLC protocol layer, which depacketizes data transferred to the application layer.

73. The method of claim 71, wherein the layer between an application layer and a physical layer is a MUX_sublayer or an MAC layer, which depacketizes data transferred from the physical layer.

74. The method of claim 69, wherein the step (a) is a step of receiving data aligned within a data unit including a length field representing the length of a payload, and depacketizing the data in the layer between the application layer and the physical layer.

75. The method of claim 72, wherein the step (a) includes a step of receiving data obtained by aligning a data unit further including fill bits within a data unit of the layer below an application layer.

76. A method of depacketizing multimedia data to receive multimedia data, comprising a step (a) of: when a layer, which depacketizes data transferred from a physical layer, is set to be a first layer, and a layer, which depacketizes data transferred to an application layer, is set to be a second layer, receiving data in which a data unit generated in the second layer is aligned within a data unit of the first layer, and depacketizing the data in the layer between the application layer and the physical layer.

77. The method of claim 76, wherein the first layer is a MUX_sublayer or an MAC layer.

78. The method of claim 76, wherein the second layer is an RLP layer or an RLC protocol layer.

79. The method of claim 76, wherein the step (a) includes the steps of:

when a layer, which depacketizes data transferred from a physical layer, is set to be a first layer, and a layer, which depacketizes data transferred to an application layer, is set to be a second layer, receiving data in which a data unit generated in the second layer, and a data unit including a length field representing the length of a payload including the data unit are aligned within a data unit of the first layer; and

depacketizing the data in the layer between the application layer and the physical layer.

80. The method of claim 79, wherein the first layer is a MUX_sublayer or an MAC layer.

81. The method of claim 79, wherein the second layer is an RLP layer or an RLC protocol layer.

82. The method of claim 76, wherein the step (a) includes the steps of:

when a layer, which depacketizes data transferred from a physical layer, is set to be a first layer, and a layer, which depacketizes data transferred to an application layer, is set to be a second layer, receiving data in which a data unit generated in the second layer, and a data unit to which fill bits and a length field representing the length of a payload including the data unit are added, are aligned within a data unit of the first layer; and

depacketizing the data in the layer between the application layer and the physical layer.

83. The method of claim 82, wherein the first layer is a MUX_sublayer or an MAC layer.

84. The method of claim 82, wherein the second layer is an RLP layer or an RLC protocol layer.

85. A method of depacketizing multimedia data to receive multimedia data, comprising a step (a) of: when a layer, which depacketizes data transferred from a physical layer, is set to be a first layer, and a layer, which depacketizes data transferred to an application layer, is set to be a second layer, receiving data in which a data unit generated in the first layer is aligned within a data unit of the physical layer, and depacketizing the data in the layer between the application layer and the physical layer.

86. The method of claim 85, wherein the first layer is a MUX_sublayer or an MAC layer.

87. The method of claim 85, wherein the step (a) includes the steps of:

when a layer, which depacketizes data transferred from a physical layer, is set to be a first layer, and a layer, which depacketizes data transferred to an application layer, is set to be a second layer, receiving data in which a data unit generated in the first layer, and a data unit to which a length field representing the length of a payload including the data unit is added, are aligned within a data unit of the physical layer; and

depacketizing the data in the layer between the application layer and the physical layer.

88. The method of claim 87, wherein the first layer is a MUX_sublayer or an MAC layer.

89. The method of claim 85, wherein the step (a) includes the steps of:

when a layer, which depacketizes data transferred from a physical layer, is set to be a first layer, and a layer, which depacketizes data transferred to an application layer, is set to be a second layer, receiving data in which a data unit generated in the first layer, and a data unit to which filling bits and a length field representing the length of a payload including the data unit are added, are aligned within a data unit of the physical layer; and

depacketizing the data in the layer between the application layer and the physical layer.

90. The method of claim 89, wherein the first layer is a MUX_sublayer or an MAC layer.

91. A method of depacketizing multimedia data to receive multimedia data, comprising a step (a) of: when a layer, which depacketizes data transferred from a physical layer, is set to be a first layer, and a layer, which depacketizes data transferred to an application layer, is set to be a second layer, receiving data in which a data unit generated in the second layer is aligned within a data unit of the first, and a data unit generated in the first layer is aligned within a data unit of the physical layer, and depacketizing the data in the layer between the application layer and the physical layer.

92. The method of claim 91, wherein the first layer is a MUX_sublayer or an MAC layer, and the second layer is an RLP layer or an RLC protocol layer.

FIG. 1

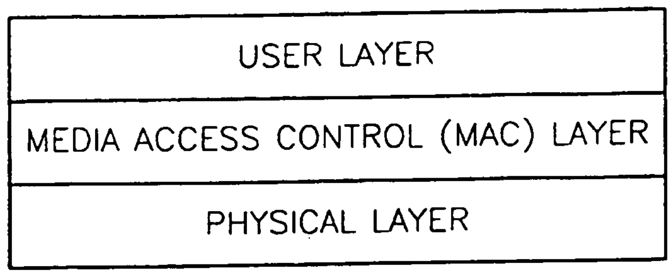

USER LAYER
MEDIA ACCESS CONTROL (MAC) LAYER
PHYSICAL LAYER

FIG. 2

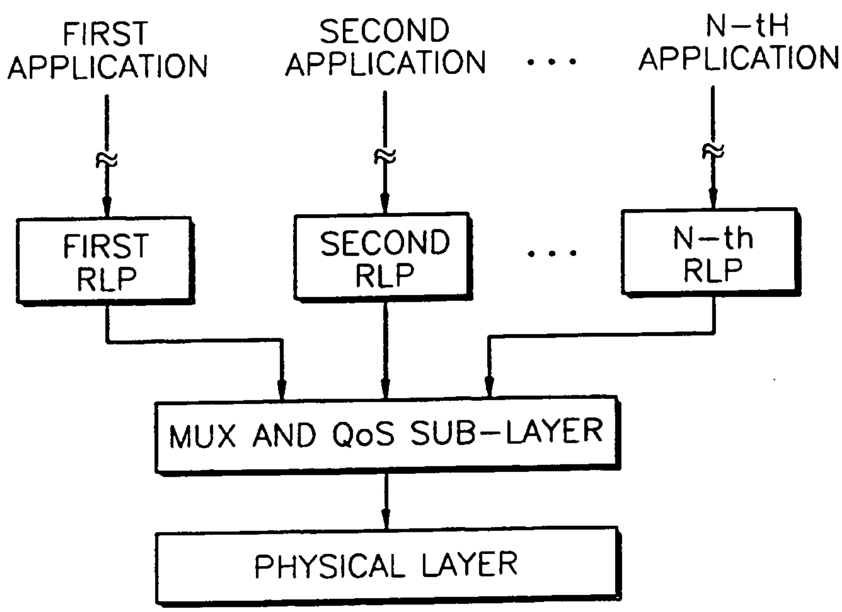

FIRST APPLICATION
SECOND APPLICATION
N-tH APPLICATION
FIRST RLP
SECOND RLP
N-th RLP
MUX AND QoS SUB-LAYER
PHYSICAL LAYER

FIG. 3

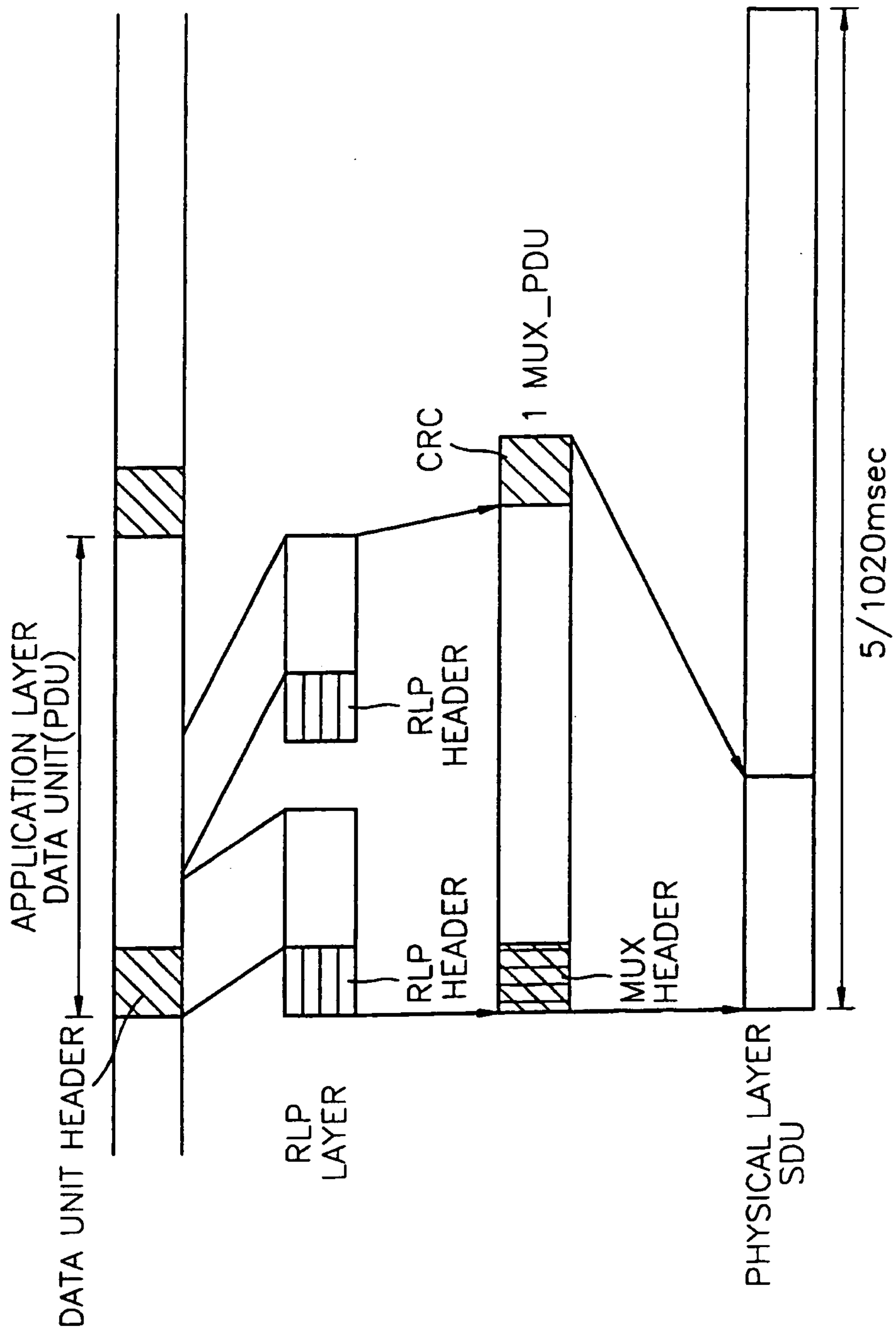

APPLICATION LAYER DATA UNIT(PDU)
DATA UNIT HEADER
RLP LAYER
RLP HEADER
RLP HEADER
CRC
1 MUX_PDU
MUX HEADER
PHYSICAL LAYER SDU
5/1020msec

FIG. 4A

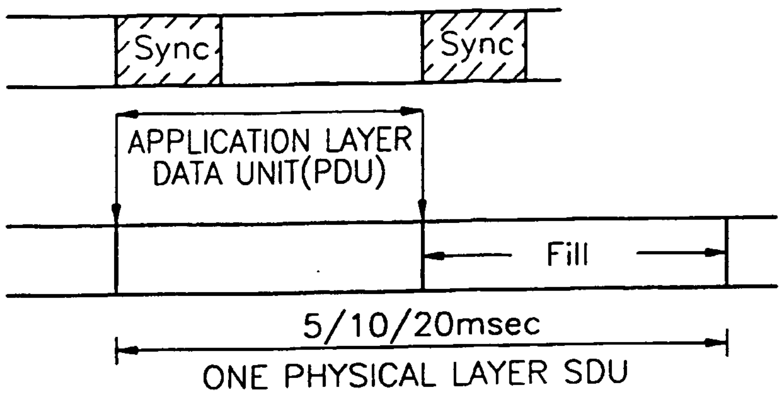
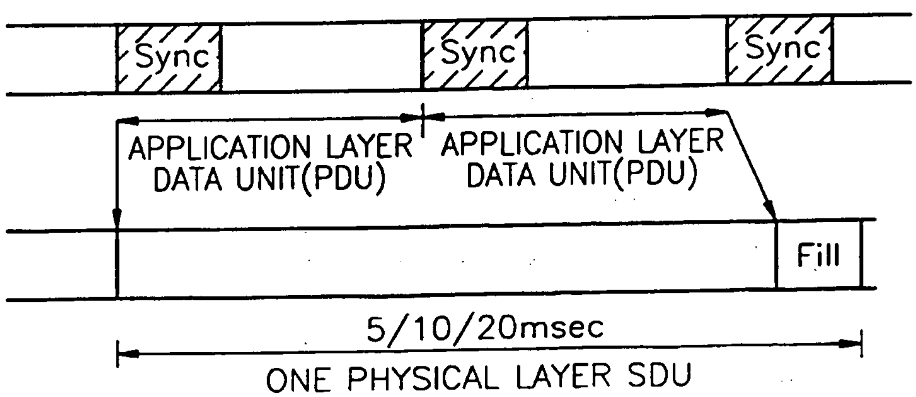

Sync
Sync
APPLICATION LAYER DATA UNIT(PDU)
Fill
5/10/20msec
ONE PHYSICAL LAYER SDU

FIG. 4B


Sync
Sync
Sync
APPLICATION LAYER DATA UNIT(PDU)
APPLICATION LAYER DATA UNIT(PDU)
Fill
5/10/20msec
ONE PHYSICAL LAYER SDU

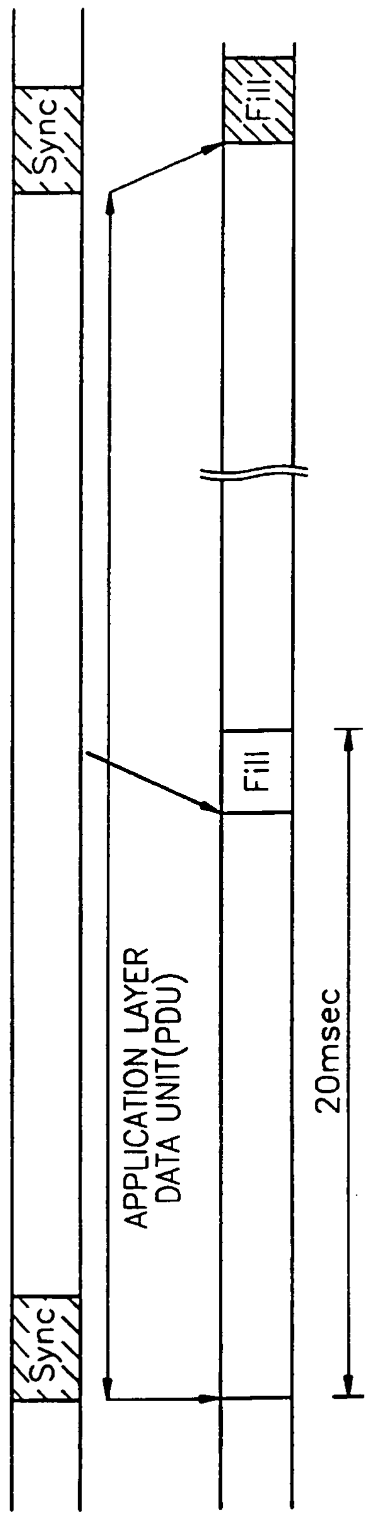

Sync
Fill
Fill
Sync
APPLICATION LAYER
DATA UNIT(PDU)
20msec

FIG. 4C

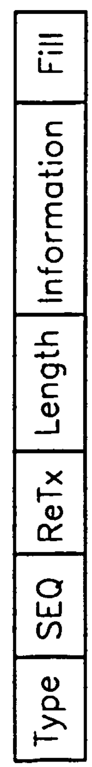

Type
SEQ
ReTx
Length
Information
Fill

FIG. 5

FIG. 6

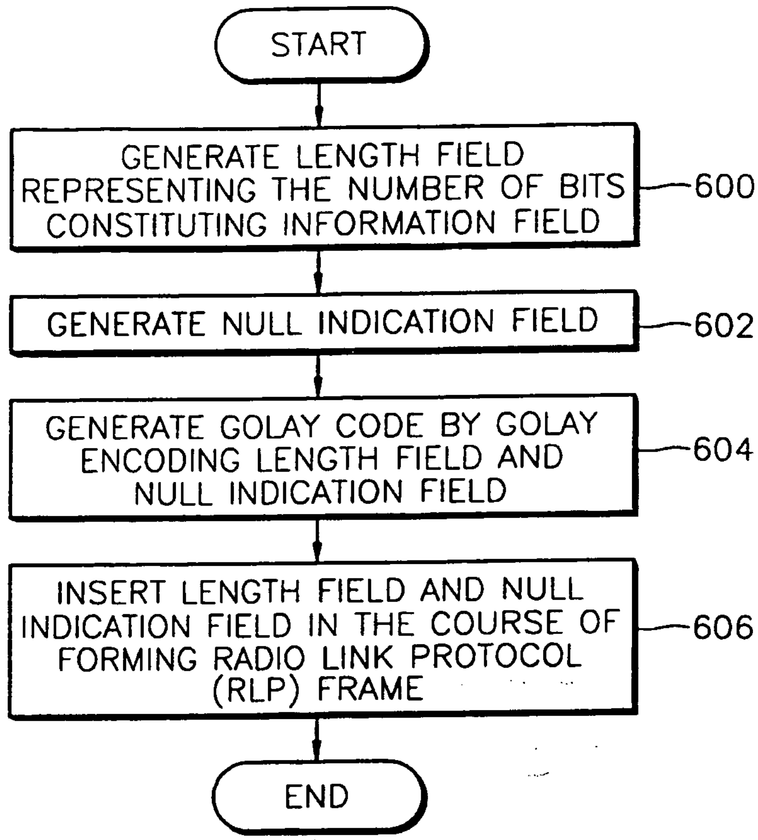

START
GENERATE LENGTH FIELD REPRESENTING THE NUMBER OF BITS CONSTITUTING INFORMATION FIELD
600
GENERATE NULL INDICATION FIELD
602
GENERATE GOLAY CODE BY GOLAY ENCODING LENGTH FIELD AND NULL INDICATION FIELD
604
INSERT LENGTH FIELD AND NULL INDICATION FIELD IN THE COURSE OF FORMING RADIO LINK PROTOCOL (RLP) FRAME
606
END

FIG. 7A

FIG. 7B

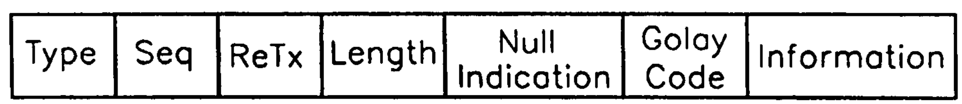


FIG. 7C

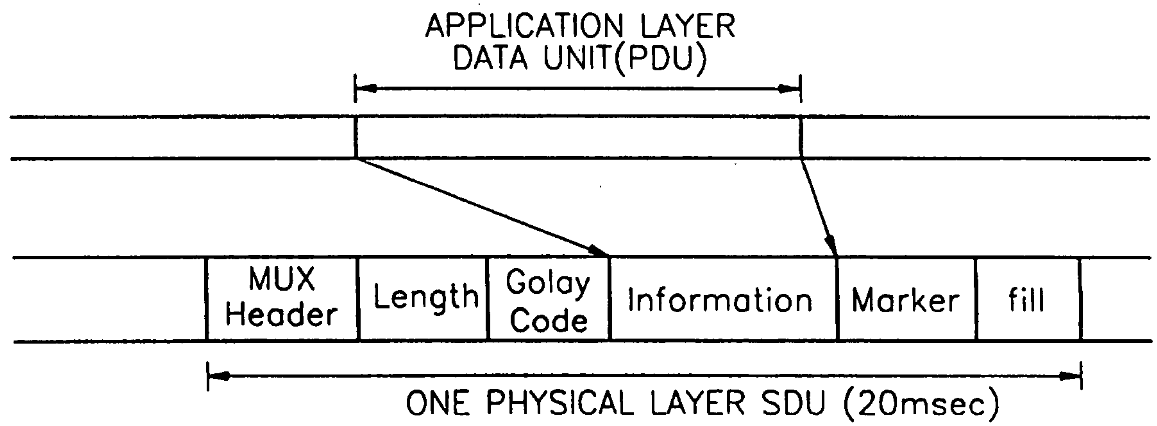


FIG. 7D

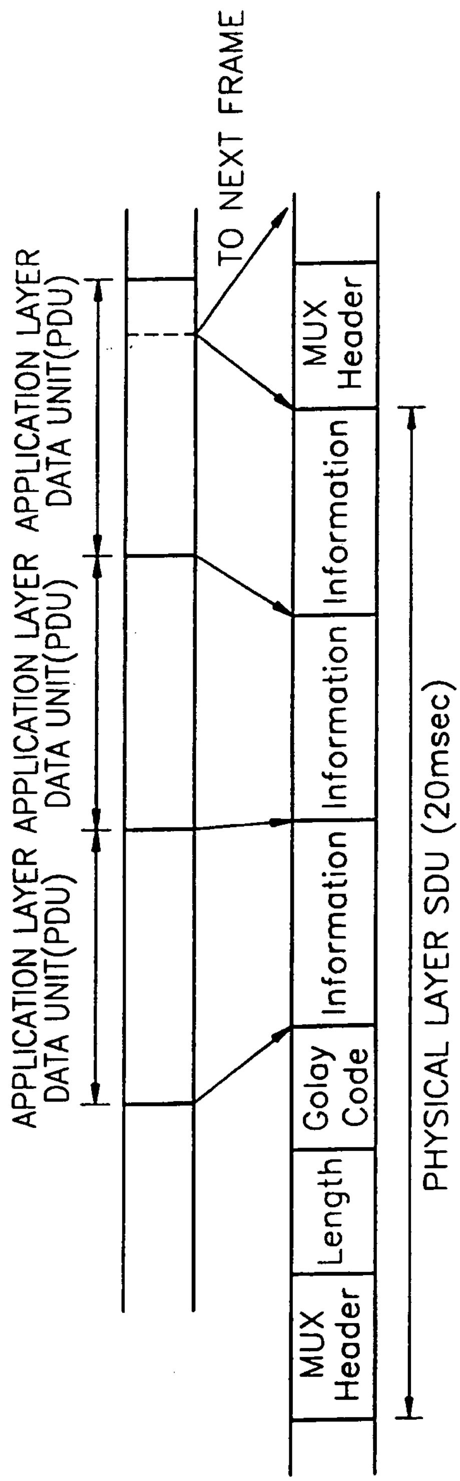

TO NEXT FRAME
APPLICATION LAYER DATA UNIT(PDU)
APPLICATION LAYER DATA UNIT(PDU)
APPLICATION LAYER DATA UNIT(PDU)
MUX Header
Information
Information
Information
Information
Golay Code
Length
MUX Header
PHYSICAL LAYER SDU (20msec)

FIG. 7E

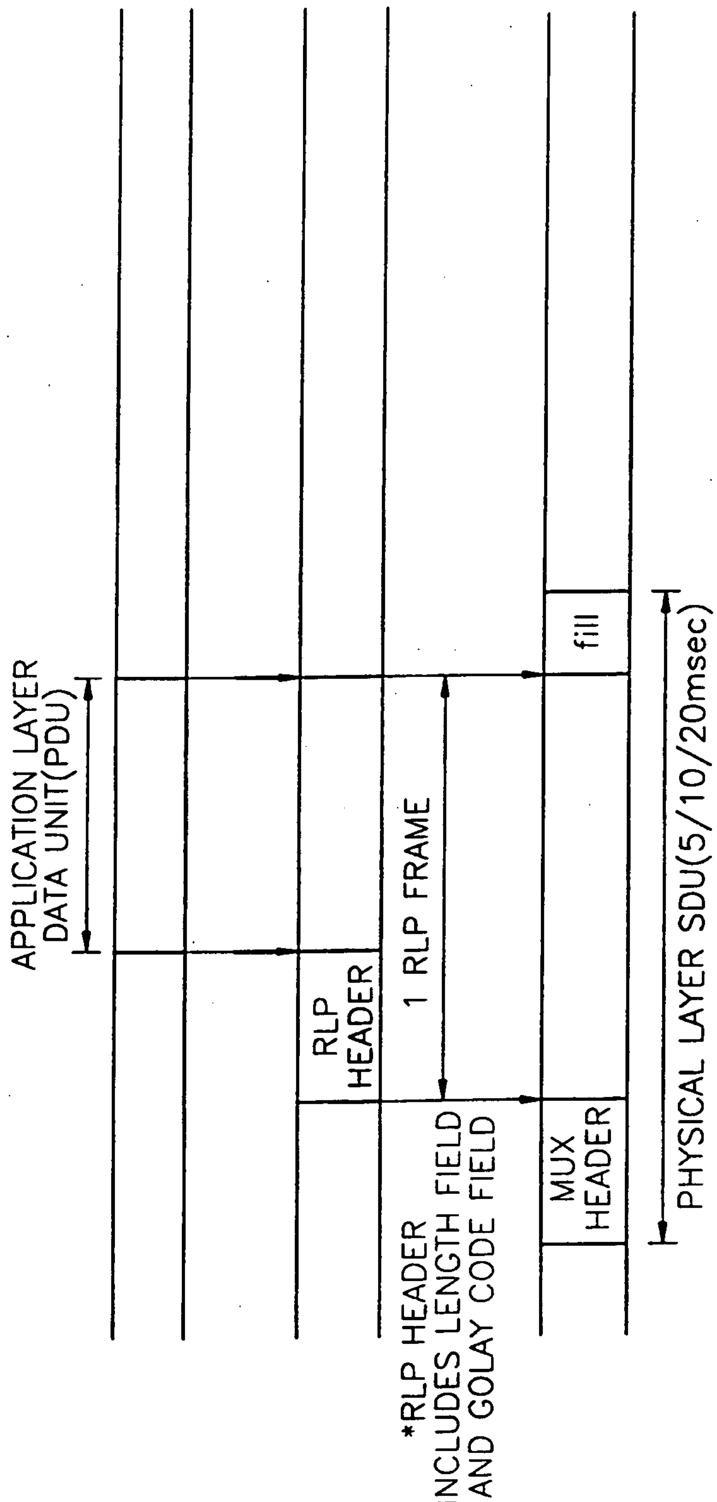

APPLICATION LAYER
DATA UNIT(PDU)
RLP
HEADER
1 RLP FRAME
*RLP HEADER
INCLUDES LENGTH FIELD
AND GOLAY CODE FIELD
MUX
HEADER
fill
PHYSICAL LAYER SDU(5/10/20msec)

FIG. 7F

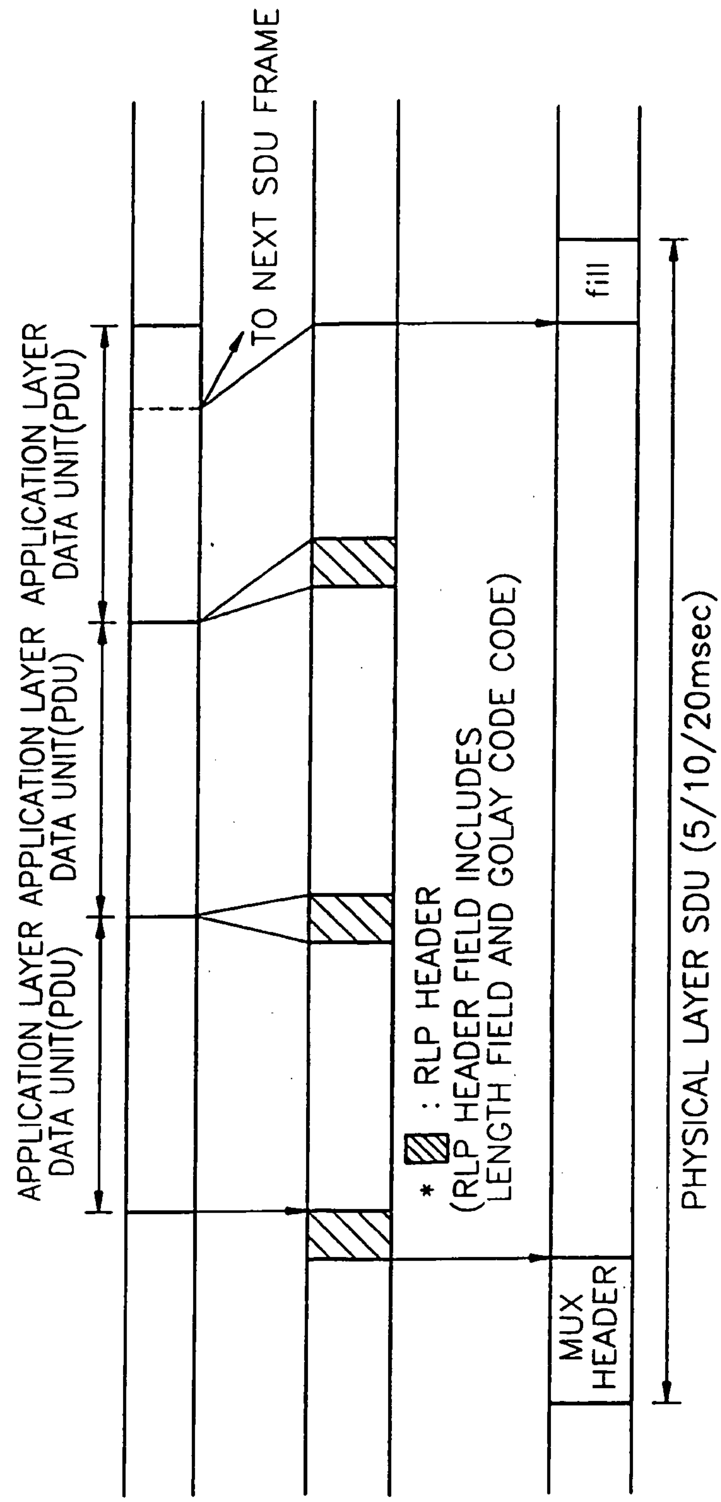

APPLICATION LAYER DATA UNIT(PDU)
APPLICATION LAYER DATA UNIT(PDU)
APPLICATION LAYER DATA UNIT(PDU)
TO NEXT SDU FRAME
* : RLP HEADER
(RLP HEADER FIELD INCLUDES LENGTH FIELD AND GOLAY CODE CODE)
MUX HEADER
fill
PHYSICAL LAYER SDU (5/10/20msec)

FIG. 8

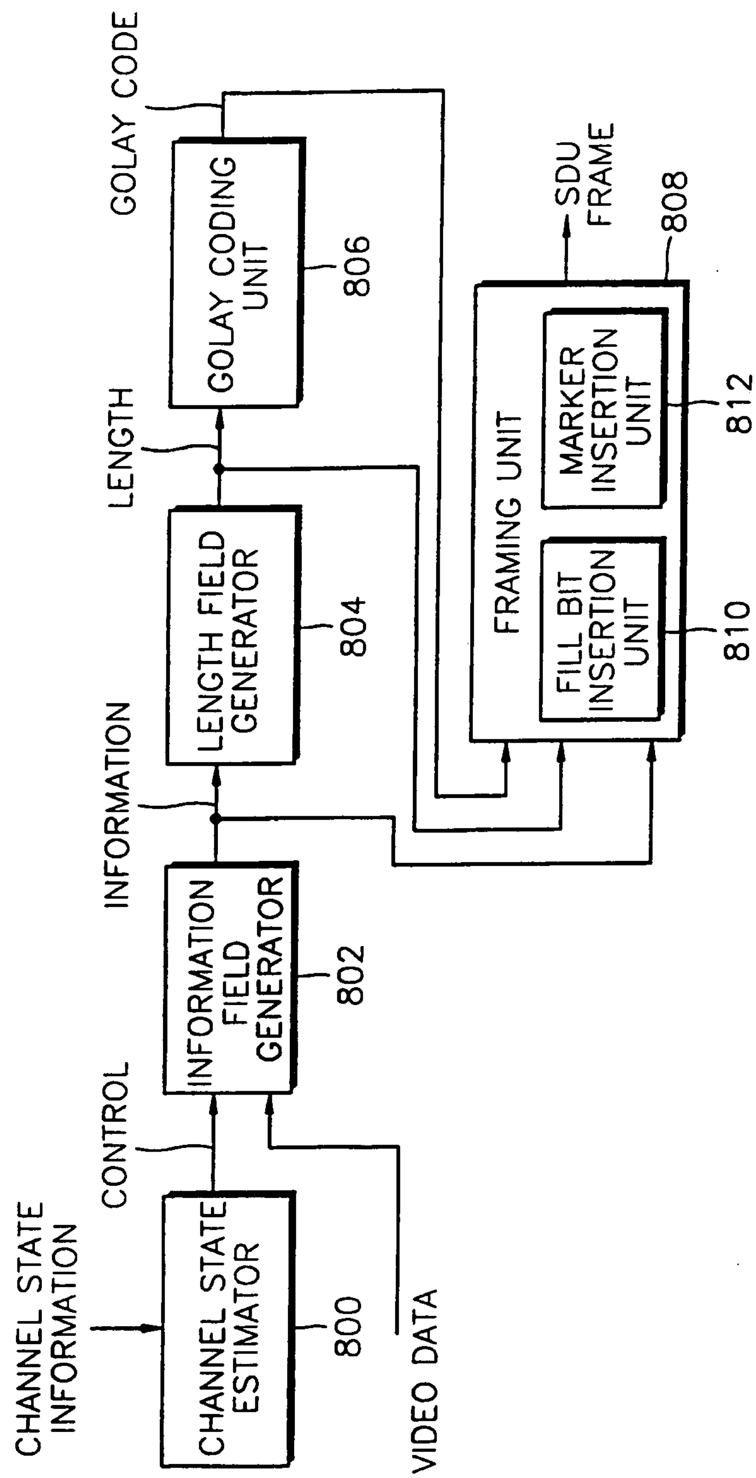

CHANNEL STATE INFORMATION
CHANNEL STATE ESTIMATOR
800
CONTROL
VIDEO DATA
INFORMATION FIELD GENERATOR
802
INFORMATION
LENGTH FIELD GENERATOR
804
LENGTH
GOLAY CODING UNIT
806
GOLAY CODE
FRAMING UNIT
FILL BIT INSERTION UNIT
810
MARKER INSERTION UNIT
812
808
SDU FRAME

FIG. 9

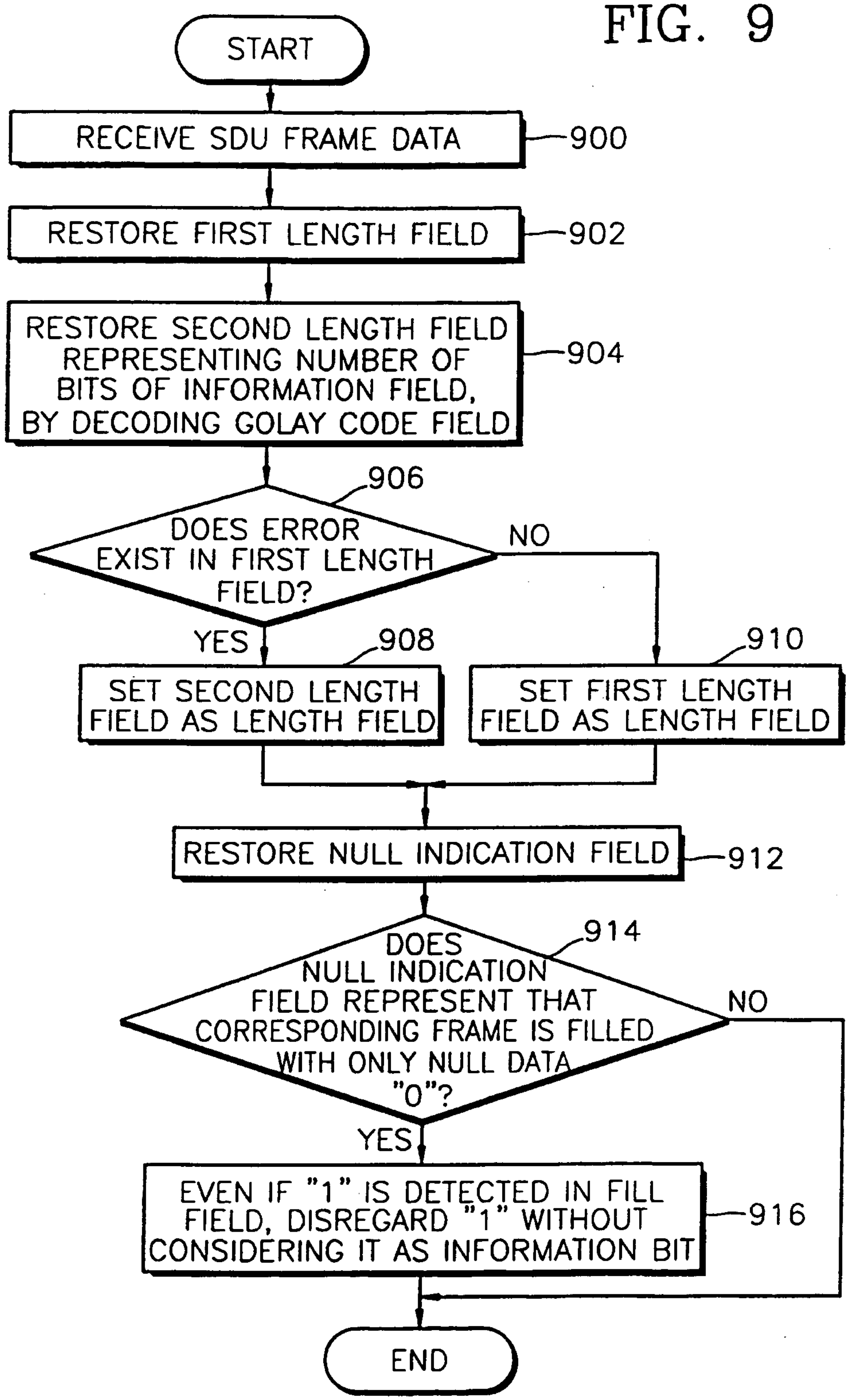
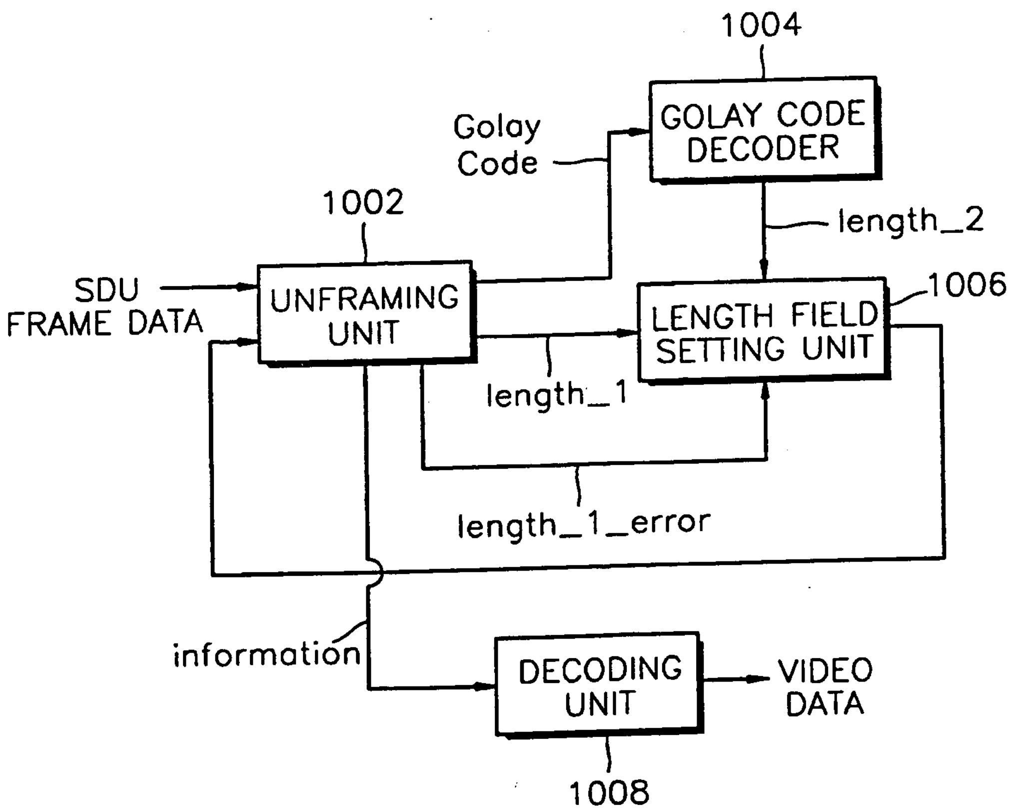

START
RECEIVE SDU FRAME DATA
900
RESTORE FIRST LENGTH FIELD
902
RESTORE SECOND LENGTH FIELD REPRESENTING NUMBER OF BITS OF INFORMATION FIELD, BY DECODING GOLAY CODE FIELD
904
906
DOES ERROR EXIST IN FIRST LENGTH FIELD?
NO
YES
908
SET SECOND LENGTH FIELD AS LENGTH FIELD
910
SET FIRST LENGTH FIELD AS LENGTH FIELD
RESTORE NULL INDICATION FIELD
912
914
DOES NULL INDICATION FIELD REPRESENT THAT CORRESPONDING FRAME IS FILLED WITH ONLY NULL DATA "0"?
NO
YES
EVEN IF "1" IS DETECTED IN FILL FIELD, DISREGARD "1" WITHOUT CONSIDERING IT AS INFORMATION BIT
916
END

FIG. 10


1004
GOLAY CODE DECODER
Golay Code
1002
length_2
SDU FRAME DATA
UNFRAMING UNIT
1006
LENGTH FIELD SETTING UNIT
length_1
length_1_error
information
DECODING UNIT
VIDEO DATA
1008

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR00/00615

A. CLASSIFICATION OF SUBJECT MATTER

IPC7 H04N 7/64

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimun documentation searched (classification system followed by classification symbols)
IPC7 H04N7/64. H04N 11/04. H04L 12/28. H04L 12/56. G06F 13/00. H03M 13/00

Documentation searched other than minimun documentation to the extent that such documents are included in the fileds searched
Korean patents and applications for inventions since 1975

Electronic data base consulted during the interternational search (name of data base and, where practicable, search trerms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 5-035624 B (MELCO:KK) 12 FEBRUARY 1993 See the whole document	1,3,4,6,32,33
Y		2,5,8,9,10,34,36,41, 45,45,50-55
A		26-31,58-61,64-66,74, 75,79-84,87-90
X	JP 7-336367 B (CANNON INC) 22 DECEMBER 1995	1,32
Y		2-10,33,34
A		11-31
Y		26,28,64,65
A		27,29,30,31,66,74,75, 79-84,87-90

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevence
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevence: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevence: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents,such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
27 SEPTEMBER 2000 (27.09.2000)	28 SEPTEMBER 2000 (28.09.2000)

Name and mailing address of the ISA/KR	Authorized officer
Korean Industrial Property Office Government Complex-Taejon, Dunsan-dong, So-ku, Taejon Metropolitan City 302-701, Republic of Korea	YOON, Byong Sam
Facsimile No. 82-42-472-7140	Telephone No. 82-42-481-5758

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR00/00615

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☒ Claims Nos.:
because they relate to part of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

Claims Nos: 35, 37, 40, 42-44, 47-49, 56, 57, 62, 63, 67-73, 76-78, 85, 86, 91, 92
Due to the broad and indefinite scope of these claims, the International Search Authority finds that for economic reasons no meaningful search could be carried on said claims.

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Search Authority found multiple inventions in this international application, as follows:

1. ☐ As all required addtional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be established without effort justifying an additional fee, this Authority did not invite payment of any addition fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/KR00/00615

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 5-035624 B	12.04.93	NONE	
JP 7-336367 B	22.12.95	NONE	
US 5497404 A	05.03.96	CA 2099436 C	27.10.94
		DE 69318629 T2	24.12.98
		EP 579075 A2	19.01.94
		JP 2788396 B2	20.08.98
		KR 128233 B1	02.04.98
		MX 9304256 A1	31.08.94

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